THE ASTRONOMICAL HISTORY OF ON AND THEBES.

II.

In relation to the extract from Brugsch, given in the last article, to the effect that there was one series of monuments with its starting point in the Delta, it must be emphatically stated that the results obtained from these monuments, studying them from the astronomical point of view, leads to a very different conclusion. Instead of one series there are distinctly two, absolutely dissimilar astronomically, and instead of one set of temple-builders going up the river there were two sets: one going up the river building temples to north stars, the other going down building temples to south stars; and the two streams practically met at Thebes, or at all events they were very fully represented there.

The double origin of the people thus suggested on astronomical grounds may be the reason of the name of "double country," used especially in the titles of kings, of the employment of two crowns, and finally of the supposed sovereignty of Set over the north, and of Horus over the south divisions of the kingdom.[1]

With regard to the start point of the temple-builders who came down the river, there is no orientation evidence, for the reason that there is little or no information from the regions south of Naga. At Naga (lat 16° 18′ N.), Meroë (lat. 16° 55′ N.), Gebel Barkal and Nuri (both in lat. 18° 30′ N.), there is information of the most important kind, but beyond Naga there is a gap; but since important structures were erected at the places named in, I think, early times (3-4000 B.C.), it is probable that the peoples who built them stretched further towards the equator.

With regard to the southern limits of Egypt in the time of Thotmes, it is supposed that the south frontier Kali of the inscriptions is probably connected with Koloë in 4° 15′ N. lat. according to Ptolemy.[2]

The authority for the general statement I have made rests upon the probable dates I have found for the first foundations of the temples of both series (N. and S. stars) which I have investigated, and here I must re-state that in almost every case that foundation precedes the generally-received date, which generally has reference to a stone building; while in all probability the first structure was a brick shrine merely, and in support of this view I may state that the looking after ruined shrines was recognised as one of the duties of kingship.

"I have caused monuments to be raised to the gods; I have embellished their sanctuaries that they may last to posterity; I have kept up their temples; I have restored again what was fallen down, and have taken care of that which was erected in former times."[3]

Not only did Thotmes III. find the original temple of Amen-Rā built in brick, but he found the temple at Semneh in brick also, and he rebuilt it in memory of Usertsen III.[4]

I have prepared a table which it is not necessary to give in this place. I bring together the foundation dates I have found most probable, bearing the above and many other considerations in mind. The dates are, of course, only provisional, since local data are in many cases wanting. Where no information is forthcoming as to the height of the horizon visible along the temple axis, I have assumed hills 1° high.

The following general conclusions may be drawn from the table:—

I. At the earlier periods there are well-marked epochs of temple-building revealed by the table.

II. The temples to the north stars, α Ursæ Majoris and γ Draconis, begin in the Delta.

III. The temples erected to the southern stars (α Centauri and Phact) begin at Gebel Barkal, Philæ, and Thebes almost simultaneously.

IV. The first north star temples for the worship of Set and Ptah were erected between 5400-4200 B.C. The series is then broken till about 3500.

V. The first south star temples (Phact at the summer solstice and α Centauri at the autumnal equinox), begin about 3700 B.C.

VI. γ Draconis replaces α Ursæ Majoris at Denderah, and north star temples are for the first time erected in the south at Karnak and Dakkeh in 3500 B.C.

VII. For the first time about 3200 B.C., N. and S. star temples are built simultaneously.

VIII. After this the building activity is chiefly limited to temples to southern stars.

If we take Brugsch's dates, we find that the foundations of the greatest number of temples were laid about the time of Seneferu, Pepi, and the twelfth dynasty. The more modern kings founded few temples, their function was that of expanding, restoring, and *annexing*. Even Thotmes III. seems to have laid no new foundations except perhaps that of the Ptah temple at Karnak, and that is doubtful.

This after all is not to be wondered at. Three thousand years of observations at least had shown that the stars were not to be trusted to fix a festival day, and the true astronomical user of the ancient temples had quite passed away. Still the ancient shrines were there, what more natural then, than to embellish them? The priests, by insisting upon the vague year had reserved to themselves a perfect means of hiding all festival difficulties for once in 1460 years; the old star would rise on the proper day of the Egyptian month, although it would be no longer visible in the temple. Indeed it is extremely probable that we have here the real reason of the priestly action. They were not fools, and they could, one would think, have had no better reason than this.

The wonderful Hall of Columns called Khu-mennu (splendid memorial), in the temple of Amen-Rā, was dedicated by Thotmes III. not only to Amen-Rā, but to his ancestors. It is interesting to note who these were in the present connection. I give them with Brugsch's dates.[1]

	B C.
Seneferu	3766
Assa	3366
Pepi	3233
The Antefs	2500
The most famous sovereigns of the twelfth dynasty	2433—2300
30 princes of the thirteenth dynasty	2233

Of these ancestors, the first limited himself to southern temples, the majority, built near Pepi's time, were south temples. The twelfth dynasty was more catholic.

The more we continue it, the more interesting does this inquiry into the north star temples as opposed to the south star temples become.

These considerations are not limited to the temples, they apply also to pyramids.

At Gizeh we find both temples and pyramids oriented east and west.

At Gebel Barkal, Nuri, and Meroë in Upper Egypt, we find both temples and pyramids facing south-east, and at the former place, where both exist together, we find well-marked groups of pyramids connected by their orientations with each temple.

In the following tables I give the values for Meroë, Nuri, and Gebel Barkal:—

Brugsch, "History," p. 6.

[2] Brugsch, "Egypt," p. 184.

[3] Inscription of Thotmes III., translated by Brugsch, "Egypt," p. 188.

[4] Brugsch, "Egypt," p. 184.

[1] Brugsch, "Egypt," p. 180.

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Meroë.

Cult.	Magnetic Azimuth.	Astronomical Amplitude.	Decl.
Pyramid 16	N. 102° E.	3½° S. of E.	S. 3¼°
Pyramid 20	N. 103 E.	4½ S. of E.	S. 4¼
Temple near Wasser Becken	N. 112 E.	13½ S. of E.	S. 12¾
Pyramid 15	N. 112 E.	13½ S. of E.	S. 12¾
Pyramids 14, 37 ...	N. 113 E.	14½ S. of E.	S. 13¾
Pyramid 10	N. 116 E.	17½ S. of E.	S. 16¾
Pyramid 39	N. 118 E.	19½ S. of E.	S. 18¾
Pyramid 19	N. 83 E.	15½ N. of E.	N. 14¾

Nuri.[2]

Cult.	Magnetic Azimuth.	Astronomical Amplitude.	Decl.
Pyramids 10, 11, 12	N. 136° E.	37½° S. of E.	S. 35¼°
Pyramids 1, 4 ...	N. 137¼ E.	38¾ S. of E.	S. 36¼
Pyramids 13, 14, 15	N. 139 E.	40½ S. of E.	S. 38
Pyramids 2, 3, 16, 17	N. 145½ E.	47 S. of E.	S. 43¾
Pyramids 5, 6, 7, 8, 9	N. 146½ E.	48 S. of E.	S. 44¾

Gebel Barkal.[3]

Cult.	Magnetic Azimuth.	Astronomical Amplitude.	Decl.
Temple E	N. 132° E.	33½° S. of E.	S. 31½°
Pyramid 18	N. 132½ E.	34 S. of E.	S. 32
Temple L	N. 136½ E.	38 S. of E.	S. 35½
Pyramids 9, 13 ...	N. 136 E.	37½ S. of E.	S. 35¼
Pyramid 11	N. 140 E.	41½ S. of E.	S. 39
Pyramid 1, 2	N. 141 E.	42½ S. of E.	S. 39¾
Temples J and H ..	N. 146 E.	47½ S. of E.	S. 44¼
Pyramid 20	N. 146 E.	47½ S. of E.	S. 44¼
Pyramids 2, 15, 16, 17	N. 147 E.	48½ S. of E.	S. 45¼
Temple B...	N. 152 E.	53½ S. of E.	S. 49¾
Pyramids 5, 6, 7, 8, 10	N. 153 E.	54½ S. of E.	S. 50½
Pyramid 19	N. 156 E.	57½ S. of E.	S. 53
Temple A	N. 170 W.	88½ S. of W.	S. 71¼

It seems quite justifiable from the above facts to conclude that the pyramids and temples oriented S.E. and, as I hold, to *α* Centauri when it heralded the autumnal equinox, were not built by people having the same astronomical ideas, worships, and mythology as those who built at Gizeh due E. and W., and marked the autumnal equinox by the heliacal rising of Antares.[4] The only thing in common was noting an equinox, and so far as this goes we may infer that neither people dwelt originally in the Nile Valley, but came by devious ways from a country or countries where the equinoxes had been made out.

J. NORMAN LOCKYER.

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[1] For plans see "Lepsius," vol. ii. 133 and 134. A west variation of 8½° has been assumed.

[2] For plans see "Lepsius," vol. ii. 130. A west variation of 8½° has been assumed.

[3] For plans see "Lepsius," vol. ii. 125 and 127. A west variation of 8½° has been assumed.

[4] There is a point of great interest here It would seem from Captain Lyons' examination of the temples at Wady Halfa, which I make out to have been oriented to *α* Centauri, that when the two races were amalgamated in later times, both the stars to which I have referred as heralding the equinox were personified by the same goddess Selk.

APPARATUS ILLUSTRATING MICHELSON'S METHOD OF OBTAINING INTERFERENCE BANDS.

IN the *American Journal of Science* for August, 1881, Captain Michelson described an ingenious method for producing interference bands, used by him in determining the relative motion of the earth and the luminiferous ether. Light from a lamp at *a* falls on a thinly silvered mirror *b*, where it divides into two rays—one, *b c*, reflected from the thinly silvered surface, is reflected back to *b* by the plane mirror *c*; the other ray traverses the glass plate *b*, and falls on the plane mirror *d*, whence it is reflected back to *b*. Here both rays reunite, and pass onward toward *e*. The mirrors *d* and *c* are silvered and polished on their front surfaces. By this means bands, similar to Newton's rings, are obtained between the mirror *c* and the reflection of *d* in *b*; the retardation of one ray with respect to the other being the length *bc-bd*; *f* is an unsilvered piece of plane glass, cut from the same piece as *b*, and placed in the ray *b c*, so as to compensate for the ray *b d* passing twice through *b*; otherwise, owing to the dispersive power of the glass in *b* different wave-lengths of light in the ray *b d* would be unequally retarded in comparison with the same wave-lengths in the ray *b c*. If the path *b c* be now equalised in length with the path *b d*, and if, moreover, the piece of glass *f* be exactly equal and parallel with *b*, the central band will be black, owing to the ray *d b* being reflected from the rarer medium, whilst *a b* is reflected from the denser medium.

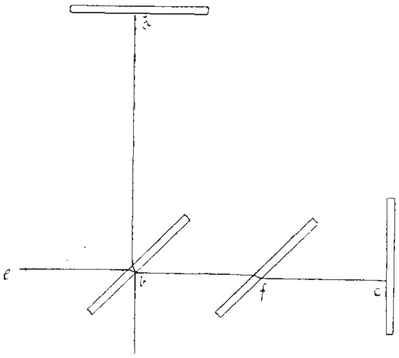

FIG. 1.

Apparatus to show these bands can be easily and cheaply set up, and owing to the fact that an extended source of light may be used, they can easily be projected, and thus many interesting experiments shown to a large audience. The following is a description of a simple construction of the apparatus which I have found to work admirably.

All the parts are mounted on a piece of plate-glass ¼″ × 9″ × 12″. The two mirrors *d* and *c*, each two inches square, were silvered by the milk-sugar process, and afterwards polished with washleather and rouge in the ordinary manner. The mirror *b* was withdrawn from the silvering solution when only a thin layer had been deposited; no polishing was necessary. The layer of silver should reflect considerably more than half the light incident upon it, as thus the reflections from the unsilvered surface of *b* become relatively insignificant. Ordinary plate-glass was used in each instance.

Each mirror was attached vertically by pitch to a stand composed of two pieces of band brass soldered together at right angles, having three feet *a*, *b*, *c* (Fig. 2). In the case of the glasses *b*, *f*, and *c* (Fig. 1), a screw of pitch $\frac{1}{20}''$ was inserted in *c* (Fig. 2) as a rough adjustment for verticality of the mirror.

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